National Aeronautics and Space Administration

Sounding Rockets Program Office Quarterly Newsletter

Rocket Report

4 1 3 2 2021

INSIDE

Cover photo:
49.004 UE Conde/C–REX 2 launch from Andoya Space, Norway. NASA Photo/Lee Wingfield.

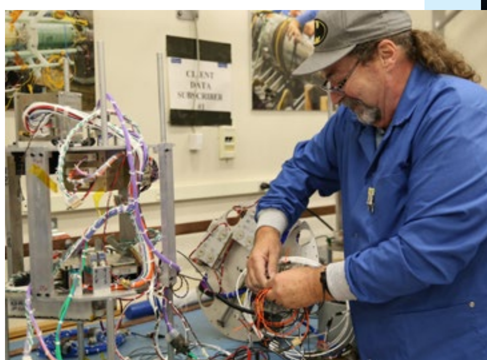
Clouds of vapor traces caused by chemical releases from the C–REX 2 payload form a grid pattern to show the movement of the wind in the upper atmosphere. The photograph was made from a NASA aircraft off the northeast coast of Greenland. Photo by Jason Ahrns.

Program News

Many long serving staff members are retiring, and we want to recognize their outstanding contributions to the program, and wish them a safe, healthy, and enjoyable retirement. Their diligence and efforts have made all the difference throughout the years.


Zeb Barfield (left), Head of the Machine Shop.


John Hickman, Deputy Chief/SRPO.


Brian Rose, Electrical Technician.


Wayne Taylor, Electrical Technician.


Lee Miles, Machinist


Jim Diehl, Electrical Engineer.

Becky Grzelachowski, Property & Logistics WSMR.
Photo by: Julia Gallegos/WSMR

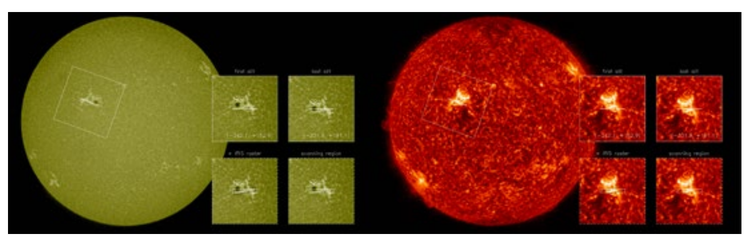
36.374 NS McKenzie/NASA MSFC - Chromospheric LAyer Spectro-Polarimeter (CLASP) 2.1 launched October 8, 2021

The Chromospheric LAyer Spectro–Polarimeter 2.1 (CLASP 2.1) was the third flight of the CLASP instrument.

Previous missions, CLASP and CLASP 2, opened a new exploration window in solar and stellar physics: ultraviolet spectropolarimetry. By measuring the polarization (a property of the electromagnetic radiation related to the orientation of its electric field) that some physical mechanisms introduce in the ultraviolet radiation emitted by the hot plasma of the solar chromosphere, it is possible to obtain information on the geometry of the plasma and its magnetism. The chromosphere is a key region of the solar atmosphere where magnetic forces start to dominate the behavior of the plasma. With an extension of a few thousands kilometers, the chromosphere is located between the relatively cool and thin photosphere and the very extended and extremely hot corona. In 2019 CLASP 2 measured, for the first time, the polarization of the ultraviolet radiation emitted by the magnesium ions and the manganese atoms of the solar chromosphere, from which the magnetic field could be determined at each position along a fixed direction on the solar disk.

The aim of CLASP2.1 was to obtain a full map of the magnetic field that permeates the chromosphere of active regions. CLASP2.1 scanned an area of the Sun and measured the intensity and polarization of the emitted ultraviolet radiation at each spatial point.

CLASP 2.1 Team with rocket at WSMR.
Photo by Mike Smith, WSMR Visual Information Branch



The region of the solar disk observed by CLASP2.1. The white rectangles in the lower right inset images of both panels indicate the area where the intensity and polarization of the ultraviolet radiation has been measured.

Reference and more information:
https://www.iac.es/en/outreach/news/clasp21–new–suborbit–al–space–mission–mapping–magnetic–field–solar–chromosphere

36.373 UG France/University of Colorado - Suborbital Imaging Spectrograph for Transition region Irradiance from Nearby Exoplanet host stars (SISTINE) - launched November 8, 2021

SISTINE was successfully launched on a NASA sounding rocket on November 8, 2021 from the White Sands Missile Range in New Mexico.

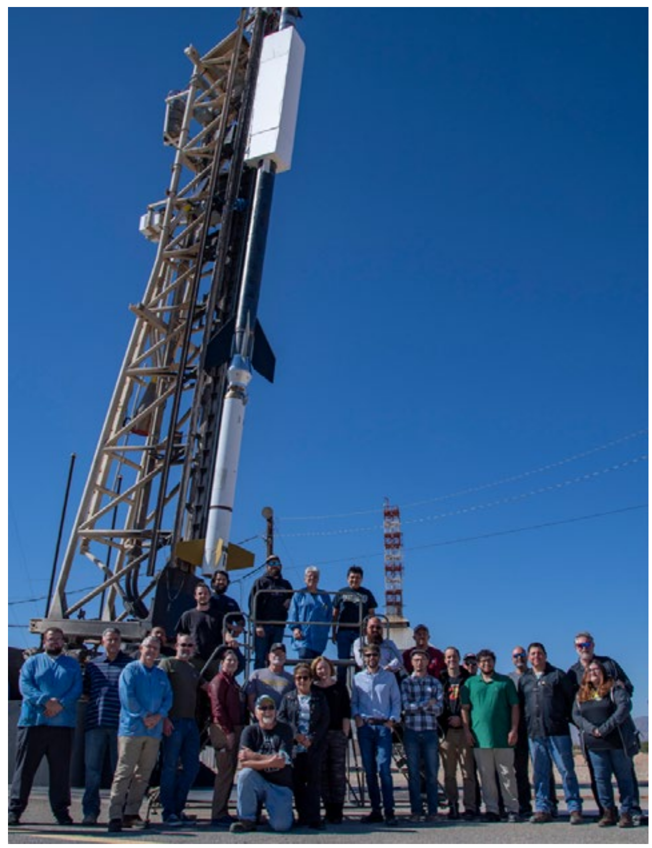
SISTINE is designed to enable studies of the ultraviolet radiation environment around low–mass stars Characterization of exoplanet atmospheres, including the potential for habitability, requires an understanding of the interaction with the host star's ultraviolet (UV) radiation environment.

F–type stars* are characterized by having a larger habitable zone (HZ) compared to stars of lower masses. The target for SISTINE–2 is the Procyon A+B binary star system composed of a late main sequence F–type star and a cool white dwarf companion. The primary target is Procyon A, with Procyon B as a secondary target. Procyon A is a good candidate for characterization of a low–to–intermediate mass star for which there are no models that accurately predict the FUV spectral energy distribution (SED). SISTINE has sufficient angular and spectral resolution to resolve both Procyon A and B in 2021 when their angular separation is approximately 4:9.

This was the second flight of SISTINE. The first flight was 36.346 in August 2019. SISTINE is being refurbished and will be flown again from Equatorial Launch Australia (ELA), near Nhulunbuy, Northern Territory in 2022.

* An F–type main–sequence star is a hydrogen–fusing star of spectral type F and luminosity class V. These stars have approximately 1.0 to 1.4 times the mass of the Sun and surface temperatures between 6,000 and 7,600 K. This temperature range gives the F–type stars a yellow–white hue.

Freddie preparing the S–19 for flight. Credit: Julia Gallegos/Visual Information Branch/WSMR.



SISTINE team at White Sands. Credit: Julia Gallegos/Visual Information Branch/WSMR.

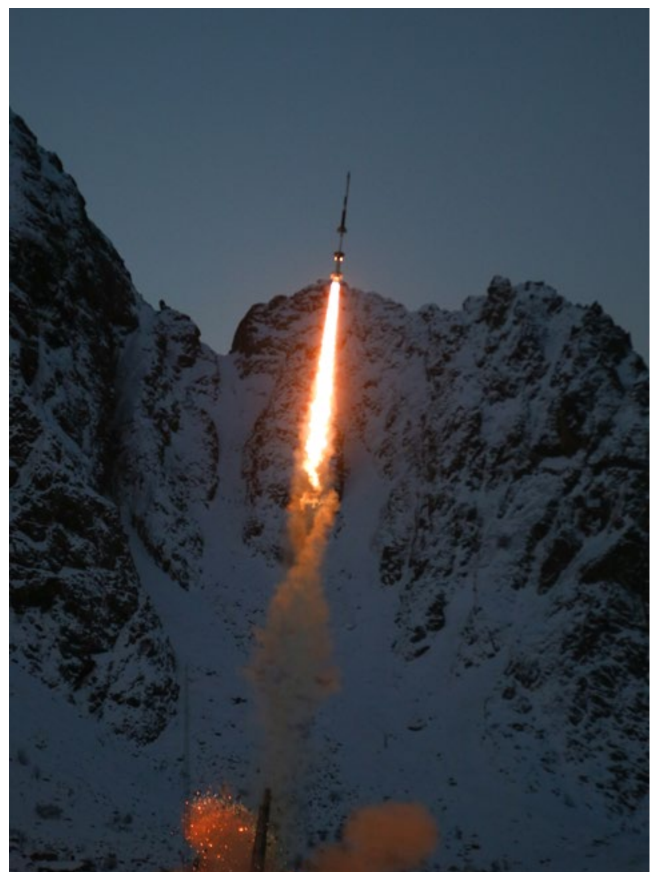
49.004 UE Conde/University of Alaska- Cusp-Region Experiment (C-REX) 2 - launched December 1, 2021

CREX–2 was the final launch of the Grand Challenge Initiative – CUSP, an international cooperative effort between Norway, Japan and the United States. C–REX 2 was originally staged for launch in 2019, but science conditions were not favorable, and the launch was re–scheduled.

For yet unexplained reasons, the Earth's atmoshere in Cusp region at altitude, is about 1.5 times denser than elsewhere. The purpose of the C–REX–2 experiment was to identify mechanisms responsible for sustaining this region of neutral mass density at about 400 km altitude that appears to be a permanent feature of the Earth's cusp–region thermosphere. Understanding the cause of the density increase and discovering the related atmospheric actions is important, for example, in making corrections to satellite orbits.

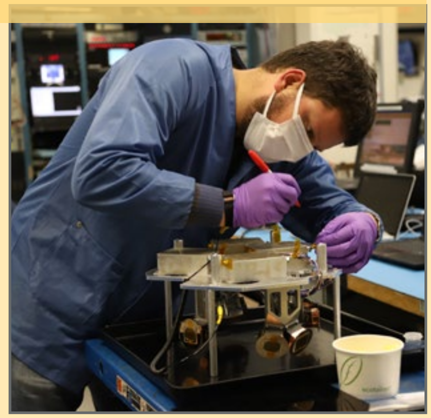
The mission studied the neutral winds by deploying 16 canisters of mixed Barium (Ba) and Strontium (Sr) tracers and 4 canisters of Tri–Methyl–Aluminum (TMA) west of Svalbard, at altitudes between 350 and 150km Additional instruments were included to characterize the electrodynamic environment.

Clouds of vapor traces caused by chemical releases from the C–REX 2 payload form a grid pattern to show the movement of the wind in the upper atmosphere. The photograph was made from a NASA aircraft off the northeast coast of Greenland. Photo by Jason Ahrns.

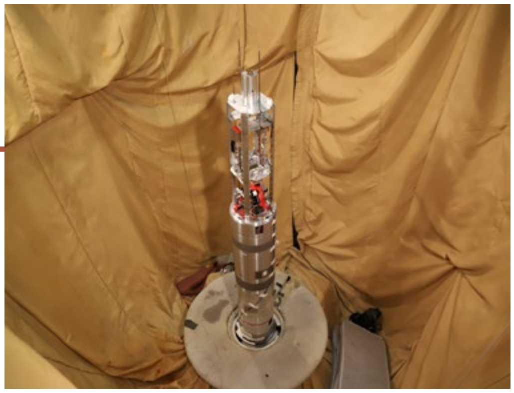


49.004 UE Conde/C–REX 2 launch from Andoya Space, Norway. NASA Photo/Lee Wingfield.

Picture Place



Integration and Testing

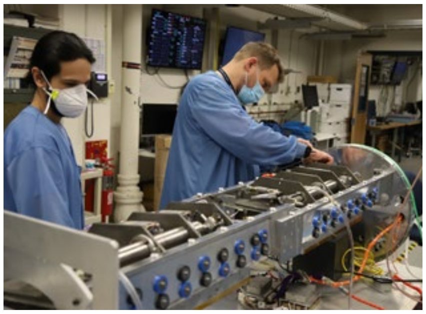


46.031 payload in the deployment bay at Wallops Flight Facility. Photo by Berit Bland/NSROC

36.360 & 46.031 UE Kaeppler/Clemson University - Ion-Neutral Coupling During Active Aurora (INCAA)

Two payloads are in integration and testing at Wallops Flight Facility. The INCAA mission is scheduled for launch from Poker Flat Reserach Range, AK in March 2022.

The science objective for the Ion–Neutral during Active Aurora (INCAA) sounding rocket mission is to understand the interactions between the plasma and the neutral atmosphere during active aurora, and how this interaction affects energy deposition in the E–region ionosphere. The mission includes two payloads: an instrumented payload (46.031) that will contain a suite of plasma and neutral in–strumentation and the vapor tracer payload (36.360). Both will be launched within 10 minutes of each other.



DXL during integration at Wallops Flight Facility. Photo by Berit Bland/NSROC

36.363 UH Galeazzi/University of Miami - Diffuse X-ray emission from the Local galaxy (DXL) 4

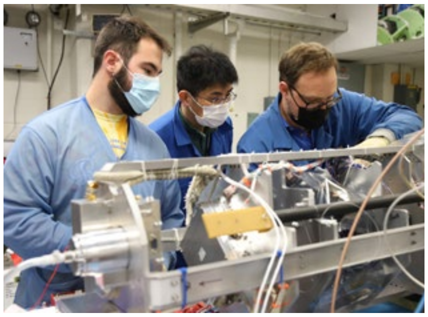
The DXL mission is scheduled for launch from Wallops Island, Va on January 4, 2022.

The purpose of the DXL–4 mission is to study the physics associated with the Solar Wind Charge Exchange (SWCX) and the Local Hot Bubble (LHB). Its goal is to identify and separate the X–ray emission generated by solar wind charge exchange from that of the local hot bubble to improve our understanding of both.

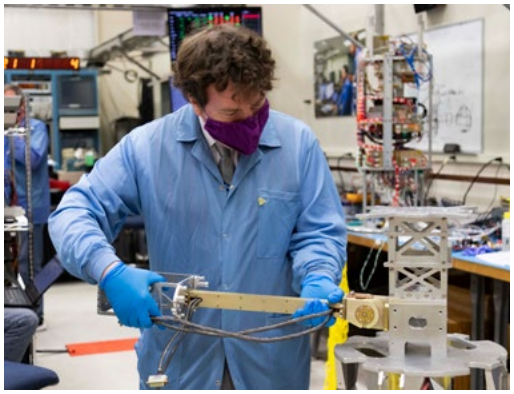
36.351 GE Halford/NASA GSFC - Loss through Auroral Microburst Pulsations (LAMP)

The LAMP mission is scheduled for launch from Poker Flat Research Range in February, 2022.

LAMP is designed to:
- Measure pulsating aurora, the highest energy aurora, to see if it plays a role in emptying the radiation belts.
- Determine the spatial distribution of microbursts with respect to pulsating patches.
- Determine if microburst “trains” are related to optical signatures of pulsating aurora; if so, determine if micro–bursts cause modulations of auroral luminosity.
- Characterize precipitating e–energy distribution of microbursts to determine if pulsating patches are associated with relativistic e–microbursts



LAMP during integration at Wallops Flight Facility. Photo by Berit Bland/NSROC



PI Dr. Collinson fit checks instruments. Photo by Berit Bland/NSROC

47.001 GE Collinson/NASA GSFC - Endurance

Endurance is scheduled for launch from Svalbard, Norway in May 2022.

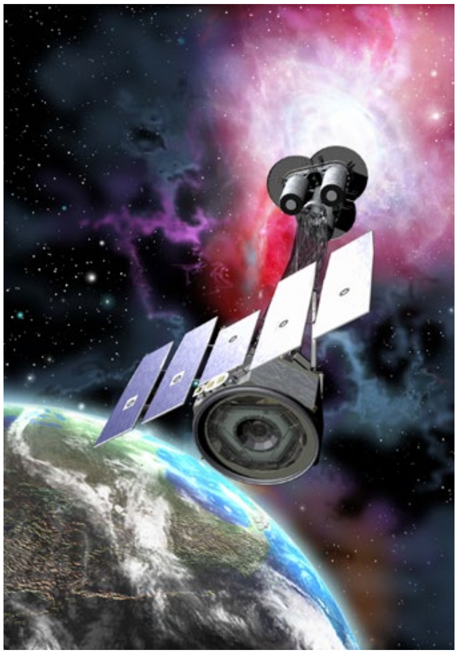
The purpose of the Endurance mission is to make the first measurement of the magnitude and struc–ture of the electric field generated by Earth’s ionosphere. The requirements to accomplish this objective are as follows: 1) launch into open magnetic field lines, away from the cusp and auroral zones; 2) minimize down–range traverse, flying as vertically as possible to obtain quasi–vertical profiles over a narrow range of flux tubes, location, and SZA; 3) fly above neutral exobase transition region; 4) fly in daytime; 5) launch during geomagnetically quiet time; and 6) launch during low EUV conditions to minimize photoelectron scattering.

From the Archives: From Aerobee to IXPE

From an Aerobee sounding rocket to NASA's latest X–ray polarimetry spacecraft.

The Imaging X–ray Polarimetry Explorer (IXPE) launched on December 9th, 2021 from Cape Canaveral on a SpaceX Falcon 9 vehicle. IXPE is placed into a 540–km circular orbit at 0° inclination. During IXPE's two–year mission, targets such as active galactic nuclei (AGN), microquasars, pulsars and pulsar wind nebulae, magnetars, accreting X–ray binaries, supernova remnants, and the Galactic center will be studied. Measuring the polarization of X–rays, i.e. X–rays with electric fields that vibrate in only one direction, traces the story of where this light came from and what it passes through, including the geometry and inner workings of its source.

NASA Aerobee 17.009 Novick.
Left to right are R. Novick, G. Epstein, M.C. Weisskopf, R. Wolff, and R. Linke.



Artists concept of the IXPE spacecraft.

December 9th was not the first time the Principal Investigator for IXPE, Dr. Weisskopf from NASA Marshall Space Flight Center launched a payload to study polarized X–rays. On February 22, 1971 the first ever measurements of polarized X–ray were made with a payload launched on an Aerobee–350 vehicle from Wallops Island, Va. The target object for the 17.009 Novick/ Columbia University, was the Crab Nebula.

The 1971 experiment included a large area lithium–scattering polarimeter, and Bragg crystal polarimeters using "ideally imperfect" crystals of graphite. At 45 degrees incidence, where the reflection depends most sensitively on the angle of the polarization vector with respect to the plane of incidence, the graphite crystal reflects, in first order, 2.6 keV X–rays. The payload was very sophisticated for the time involving 4 doors on the sides of the rocket containing the panels of graphite crystals. These doors had to open once the rocket cleared the upper atmosphere and three of the four doors opened successfully.

This flight led to the first detection of X–ray polarization of an extra–terrestrial X–ray source and found P=(15±5)% at a position angle of (156±10)° measured positive north by northeast. This success, lead NASA to include a crystal polarimeter on the Orbiting Solar Observatory (OSO) 8 satellite. OSO–8 observations of the Crab produced a high–precision measurement of the nebular polarization

Ref.
High Energy Polarization and the Crab: Historical Remarks, Martin C. Weisskopf
https://arxiv.org/ftp/arxiv/papers/0908/0908.2438.pdf
Detection of X–Ray Polarization of the Crab Nebula
Novick, R. ; Weisskopf, M. C. ; Berthelsdorf, R. ; Linke, R. ; Wolff, R. S.
https://ui.adsabs.harvard.edu/abs/1972ApJ...174L...1N/abstract

For more on IXPE, visit: https://www.nasa.gov/mission_pages/ixpe/index.html

SCHEDULE

MISSION	DISCIPLINE	EXPERIMENTER	ORGANIZATION	PROJECT	RANGE	DATE
36.363 UH	HIGH ENERGY ASTROPHYSICS	GALEAZZI	UNIV OF MIAMI	DXL 3	WI	01/04/22
36.351 GE	GEOSPACE SCIENCES	HALFORD	GSFC	LAMP	FB	02/24/22
36.307 DS	SOLAR & HELIOSPHERIC	TUN	NAVAL RESEARCH LAB	HERSCHEL	WS	03/07/22
36.360 UE	GEOSPACE SCIENCES	KAEPPLER	CLEMSON UNIVERSITY	INCAA	FB	03/25/22
46.031 UE	GEOSPACE SCIENCES	KAEPPLER	CLEMSON UNIVERSITY	INCAA	FB	03/25/22

WI – Wallops Island, VA
FB – Fairbanks, AK
WS – White Sands Missile Range, NM

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